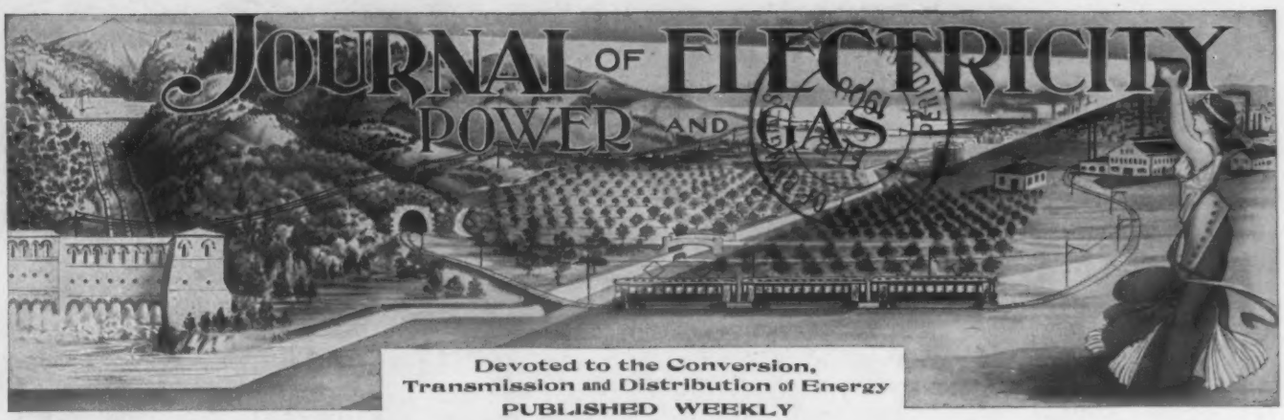

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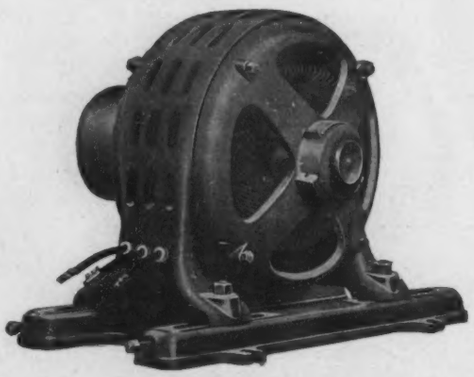

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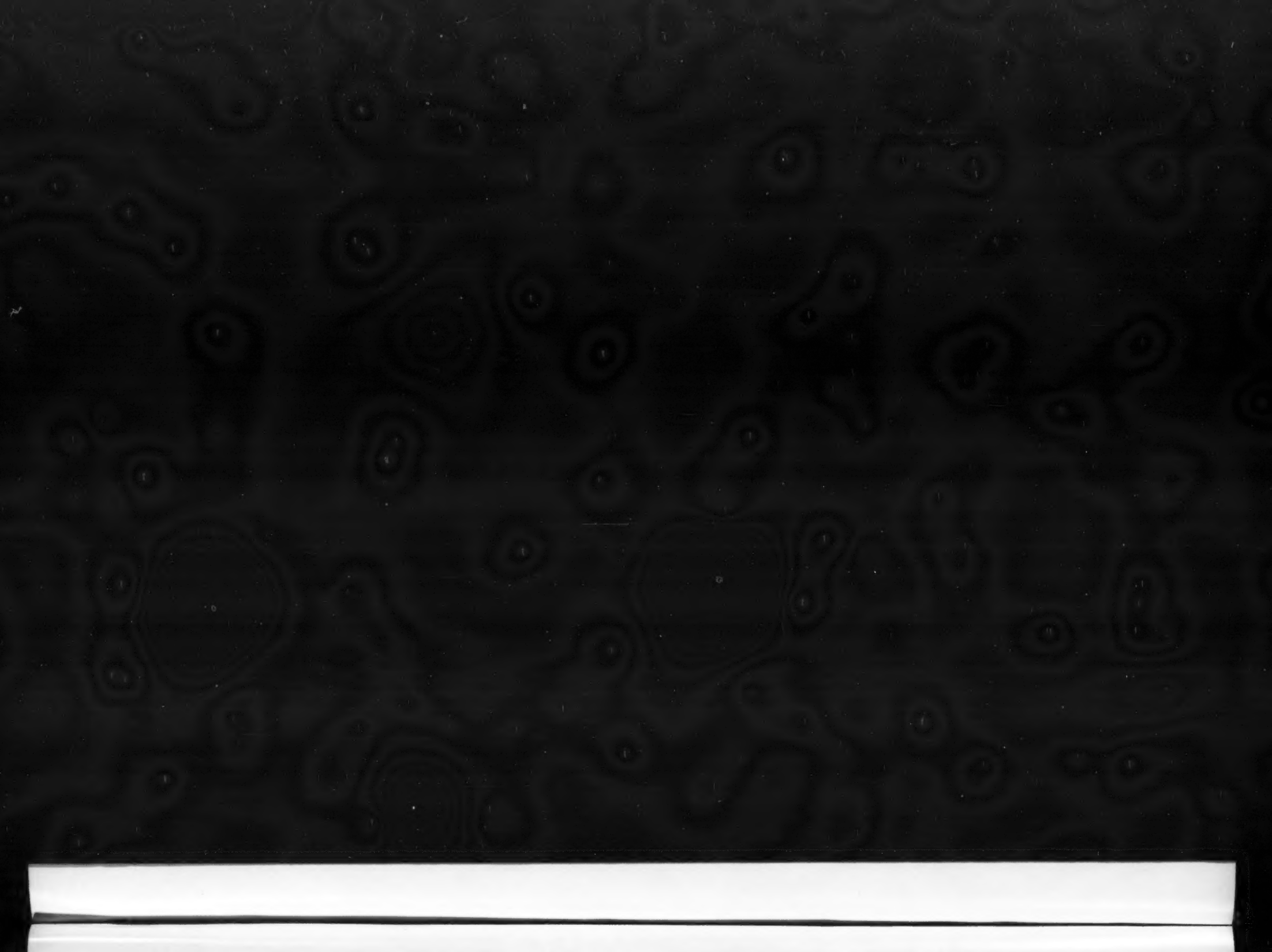

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Devoted to the Conversion, Transmission and Distribution of Energy.

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ELECTRIFICATION OF RAILWAYS.*

By DR. GISBERT KAPP.

Before beginning to write out these lectures I did what specialists generally do—namely, looked in the "Encyclopaedia Britannica" in the hope of finding a comprehensive article about the early history of the subject which might be utilized. In this I was, however, disappointed; the "Britannica" mentions only one case of the early history of electric propulsion on a railway, and gives no details. It says merely that a certain R. Davidson had constructed an electric locomotive which weighed five tons and was run at a speed of four miles per hour over the Edinburgh-Glasgow Railway. The date given is September, 1842. As in those days the trolley was unknown, we must conclude that this locomotive, like the well-known boat of Prof. Jacoby, was propelled by current derived from primary batteries.

The first electric railway in the modern sense of the term (that is, with current supplied to the motor by a conductor from a source fixed outside the vehicle), was undoubtedly that shown at an exhibition in Berlin in 1879 by Werner von Siemens. Although more like an interesting toy in appearance, it had most of the characteristics of later work. A 3-horsepower motor was mounted on wheels and connected by spur gear with the axles. This was the locomotive, and it drew a few small carriages with seating accommodation for a few passengers after it. The speed

SINGLE PHASE-A. C. ELECTRIC ROAD AT SPOKANE, WASH.

*Lecture delivered before the Royal Institution of Great Britain.

was four miles per hour. The current had a pressure of 150 volts, and was brought to the motor by a "third rail" laid between the track rails, and a sliding contact was used as a connecting link between the conductor and the motor. The return current was taken back to the generating dynamo by the track rails. We have here some of the essential elements of the modern electric railway, and it is rather surprising to find that Werner Siemens in his next application of electricity to the propulsion of a vehicle on rails abandoned the principle of the "third rail," and used the track rails both as lead and return conductors. This was in the electric tram-line at Lichterfelde, near Berlin, joining the railway station with the military academy. The voltage was 180 volts, and the maximum speed attained 23 miles per hour. The gauge was 1m., and the car weighed, with its full complement of 26 persons, 4.8 tons. Very soon after—namely, in 1883—the well-known Portrush-Bushmills line in Ireland was opened. This is a line with 3 ft. gauge six miles long, and containing gradients up to 28 per 1,000. Here the third rail (19 lb. per yard) is again used with return through track rails, and the speed on the level is 12 miles per hour. In America the first electric line was opened for traffic one year later, and from 1884 onwards there has been a steady development of electric traction, first for tramways and then for main lines of railway. I do not propose to sketch the history of this development in detail, as that would leave me no time for the treatment of the technical side, but I may draw attention to one landmark in this history—namely, the work done by a group of technical and financial men who formed a committee for the "study of high speed electric railways." By the close of the last century there had already been electrified various main lines, both in Europe and America, but the speeds were moderate, and the experience thus far obtained was hardly of the nature to enable engineers to predict what would happen if electrification were attempted at speeds equalling or exceeding the fastest runs of steam locomotives. It was to collect data on the various points affected by speed that the famous Zossen trials were made with two cars built by rival firms. With an expenditure of 1,000 horsepower the car attained a speed of 125 miles per hour. It was fitted with four three-phase motors of nominally 250 horsepower each, but on starting the motors could be heavily overloaded, the total intake of power by the car amounting for short periods to as much as 3,000 horsepower. The car weighed 94.5 tons. The working pressure was 10,000 volts, three-phase current supplied by three lines erected vertically above each other by the side of the track. This method of arranging the trolley wires requires so much head room as to render the system inapplicable to existing lines on account of bridges and tunnels. The value of the Zossen trials lies, therefore, not in proving that high-speed electric traction is possible with the particular arrangement chosen, but in providing data on which to calculate the power required at high speeds and in the demonstration that it is possible to take off as much as 1,000 horsepower at so high a speed as 125 miles per hour. It should be noted that before the highest speed could be attempted the permanent way had to be strengthened.

Advantages of Electrification.

It might be asked, Why should we electrify main lines? The answer is that we want to travel more frequently, more quickly, more safely, in greater comfort, and, if possible, more cheaply than by steam. As regards greater comfort and more frequent opportunity of travel, the superiority of electric traction has been demonstrated by the lines already electrified. As regards greater economy, the proof is as yet doubtful, but it would obviously be premature to deny greater economy merely on the ground that it has not yet been attained in the few isolated—and I might say, tentative—installations started up to the present. When the electric light was first introduced into our homes we had to pay 8d. a unit, but now, with its more general application, the average price has come down to about half that sum. So it will be with electric travel. A few dozen miles electrified here and there can hardly be expected to result in great economies, but let the whole system be electrified and any inherent advantage in an economical sense must make itself felt. The economy will naturally be greatest in the countries where coal is dearest, and it is for this reason that we see the Swedish, Italian, and Swiss Governments considering the introduction of electric working on a large scale.

The increase in traffic capacity, and especially the ability of the electric locomotive to handle heavier trains at higher speed, is due to the circumstance that, unlike the steam locomotive, it has not to carry the part that generates the power with it, but only the part that utilizes the power. In a steam locomotive the power is limited by the capacity of the boiler to generate steam. There is no such limitation in the electric locomotive, for the boiler (in the case that water power is not used) may be of any required size; there may be any number of boilers, and they may be arranged to burn any kind of fuel. There is no limitation to the power generated, but only to the power the motors on the locomotive can take up. Thus with equal total weight the capacity for dealing with heavy traffic is far greater in the case of the electric locomotive than in that of the steam locomotive. In this comparison I do not only mean drawbar pull, but the sustained effort of a strong pull exerted at high speed—in short, the horsepower. A modern electric express locomotive will develop about 30 horsepower for every ton of its own weight, and if built for slow passenger or fast goods service the power is about 22 horsepower, whilst even for slow goods service on heavy grades the power developed per ton of its own weight is still 10 horsepower to 12 horsepower. These figures are based on the generally accepted rating of a temperature rise of 75 deg. C. after one hour's run. For shorter runs the power will, of course, exceed the limits here given.

Another advantage of electric driving is the ability of exerting a greater drawbar pull at starting and on heavy grades, not only when by reason of motor coaches the adhesive weight is increased, but even in the case of locomotive traction for the same adhesive weight. In a steam locomotive the crank effort is not uniform. The skidding point is determined by its maximum, and the drawbar pull by its mean value. In the electric locomotive the crank effort is uniform, and it will, therefore, with the same adhesive weight and the same safe margin against skidding, have a 30 to 40 per cent greater drawbar pull than the steam locomotive. There is also greater safety against toppling over when going round curves. The modern steam locomotive with its enormous boiler has a high center of gravity, in some cases 5 ft. to 6 ft. above rail level; the center of gravity of an electric locomotive is only 3 ft. 6 in. to 4 ft. above rail level. Owing to the absence of reciprocating masses, the working is smoother and the wear on rails less; and, finally, as more of the total weight may be utilized for adhesion, and as the adhesive weight itself

is more effective, the traffic capacity of a given line can by electrification be increased, without those alterations in the permanent way which would be necessary if the same increase of traffic capacity were attempted by the use of heavier steam locomotives.

Then there is the question of economy in fuel and labor. By the latter I do not mean the labor actually required in driving a train. Although a fireman is not required, it would not be prudent to have only one man on the footplate on long express runs, although on short-stop runs this is perfectly safe. The saving of labor will come in consequence of the simplified service generally. There are no trips to the round house for cleaning tubes, and the labor in taking up brasses and generally keeping the gear in order will be much less than with the highly complicated mechanism of a steam locomotive. The ability to run in either direction makes the turntable superfluous, whilst multiple control applied to motor coaches at both ends of the train greatly simplifies the make-up of trains. As regards the fuel consumption whilst the train is actually running, there is probably no other economy than can be obtained by the possibility of using a cheaper kind of fuel in the fixed boilers, since the better efficiency of fixed boilers and engines is offset by the losses in transmission and conversion; but we must remember that a locomotive is much longer under steam than in actual service, and that during the time it stands waiting or makes trips necessary in putting trains together (what railwaymen call shifting) fuel is also consumed. The electric locomotive consumes no fuel at the power house except when actually at work.

All these are undoubted advantages, but what are the **objections to electric propulsion.** There can be no question that the electrical equipment of a train is as reliable as any mechanical apparatus can be, perhaps more so, because it is easy to fit safety appliances which will prevent overloading any part. Even under such trying conditions as the Simplon Tunnel, with its moisture and heat, means have been found of rendering electric working perfectly reliable. If electric traction has a weak part, it is certainly not in the train itself, but in the link between power house and train —that is to say, in the conductor with its sliding contact. That this weakness is not a serious matter is shown by the fact that many hundreds of miles of electrified main line are now in successful operation, but still there are difficulties, and it is interesting to briefly glance at them and at the means applied to overcome them. Of the two systems—viz., a third rail on the ground and by overhead conductor —each brings its own difficulties. The third rail is an obstruction. It may become a very complicated affair where many roads meet and cross. It may be a source of danger to persons walking or working on the line, and it may fail to act if its working surface is covered with ice. The overhead conductor has the advantage of leaving the permanent way perfectly free from encumbrance, and there is less difficulty at points and crossings, but it may obstruct the view of signals. That steam locomotives are sometimes also offenders in this respect was shown by the terminus of the New York Central Railway before that line was electrified. Here smoke and steam render the signals invisible, and as the obstructing body is continually shifting there is no remedy. A network of overhead wires may also obstruct the view, but this kind of obstruction does not change its position, and it is, therefore, possible to so place the signals that they are permanently visible. The single-phase line erected by the Westinghouse Company and a part of the three-phase line leading to the Simplon Tunnel shows this. In both cases the signals are perfectly visible.

In most of the third-rail equipment used at present the working face of the conductor is on the top. This has certain disadvantages. The lower edge is only about 4 inches above the sleepers, so that the danger of earthing from accumulation of wet snow and ashes or from even a slight flooding of the line is present; it is difficult to guard the conductor from contact without at the same time interfering with the contact surface, and the latter cannot be completely protected from snow and ice. To overcome these defects, Messrs. Sprague and Wilgus have introduced a type of third rail with "under-running contact shoe." The lower edge of the third rail, which is also the working face, is 9 inches above the sleeper and nearly 3 inches above the top of rail. The exposed part is sheathed with a fibre trough, leaving only the underside free for the contact, and although sleet may accumulate on the top and side of the rail it does not adhere to the contact face. On the New York Central system 285 miles of track are now being equipped with the Sprague-Wilgus third rail, and some other American lines have also adopted it.

In overhead construction for high speeds care must be taken to keep the conductor as straight as possible, as any sharp bends will cause the contact piece to jump and by drawing an arc to damage the wire. This was the reason why in the Zossen experimental line a side contact was provided. It was thought that with such an arrangement the sag of the wire could not affect the relative position of wire and contact piece, and this reasoning has proved perfectly correct. As, however, the head room necessary for the Zossen arrangement renders its adoption on existing lines impossible, another solution had to be found. This is the suspension by catenary. The catenary itself may have any sag required to render the system almost independent of temperature variation, and the suspension of the contact wire is effected by hangers of varying length, so that all the suspending points are exactly on the same level. Since the hangers can be placed fairly close to each other (three to ten yards), the sag of the contact wire can be made imperceptible. There is the further advantage that in the event of the contact wire breaking it will dangle free and not reach the ground. This is shown by the arrangements of the "single catenary system" used by the General Electric Company, and the double "catenary system" used by the Westinghouse Company and on the Swedish State Railways. On the latter the trolley wire is sub-divided into sections, one end of each section being anchored and the other attached to blocks and falls and a weight, which puts a definite tension on the wire whatever the change of length may be. The suspending arms are, of course, hinged to allow for automatic adjustment. Messrs. Siemens-Schuckertwerke have carried the catenary system still a step further by arranging two catenaries one above the other. The uppermost has long spans, and the lower is attached to it at frequent intervals by adjustable straps, the adjustment being possible in a vertical direction by altering the length of the strap and in a horizontal direction by shifting the clamp on the trolley wire. Stiffness at right angles to the axis of the trolley wire is obtained by horizontal pull-off wires. It should be noted that in all these systems the catenaries and all wires attached to them are insulated, so that the trolley wire is doubly, and in some cases trebly, insulated from earth.

To be continued.

REHABILITATION OF SAN FRANCISCO'S STREET RAILWAYS.

By Arthur H. Halloran.

(Concluded.)

Lower Market Street had never been brought up to the official grade by the city, and as a consequence, before the fire, the sidewalks of all the new buildings were laid 4½ feet above the street level. Repairing the fire's damage offered an unequalled opportunity to remedy this, and at the same time lay sewers and conduits. Advantage was taken of this chance by the Home Telephone Company, the City Electric Company, the Postal Telegraph Company, the Department of Electricity, and the United Railroads to install duct lines. The municipality let contracts to build two lines of sewers, one on either side of the street, this work naturally having precedence over all others. At the same time the Spring Valley Water Company was repairing its water mains, the San Francisco Gas & Electric Company was similarly engaged on its gas mains and electric distribution system, and the Mutual Electric Company was repairing its conduits. New culverts were also put in by the city, and in addition, new buildings were being erected on Market and side streets. This part of the city is all made ground, and immense pile drivers were at work on all sides driving piles for suitable foundations. Meanwhile the United Railroads not only had to install new electric tracks, replacing the old cable road-bed, but also had to maintain continuous service over its lines. The resulting chaos rendered work difficult, in the blinding dust or deep mud that prevailed respectively during the summer and winter of 1907, while this work was carried to completion. Such confusion could not but give a most unpleasant and unfavorable impression to visitors, especially if they had to pick their way through the resulting debris during the needless strikes that tied up the railroad lines for a little while during this period. A broad expanse of smooth asphalt now completely covers all this travail which will soon become but a memory.

Originally, two cable tracks, flanked on either side by the Sutter Street horse-car lines, handled all the street railway traffic of San Francisco's main east and west artery. At the Ferry terminus a turn-table reversed the incoming cars, and placed them on the outgoing track, or on one of the dead tracks laid for idle or mail cars, or to get one ahead of another. As a result, during the rush hours there was necessarily great congestion. Immediately after the fire cross-overs were put in at the terminal, and the electric cars were thus run from the "down" south track on to the "out" north track. As this was entirely inadequate, in October, 1906, a loop was laid in front of the Ferry Building, later supplemented by an inner loop recently completed. The straight tracks in the center, now used for observation car storage, will be removed and a spur track will be run for this purpose to connect with the Mission and Folsom Street tracks, which come in at East St.

SAN FRANCISCO FERRY LOOP.

While the city was putting in its north sewer between Sansome Street and the Ferry, a temporary track was laid on the south side of Market Street and connected with the south loop, and the south cable track connected with the north loop, leaving the north cable track dead. When the north sewer was completed, work was started on the south. Consequently, the temporary south track was torn up and placed on the north side of the street, being connected with the north loop, the north cable track being similarly joined

to the south loop, leaving the south cable track dead.

When the sewers were finished, the north track was constructed on the new grade on the site of the Sutter Street horse-car tracks, likewise for the south track. In the meantime the cars were run on the old center cable tracks, by this time a trough, from one to four feet deep. With permanent tracks completed on either side, and a 60-day permit to erect overhead wires granted for construction purposes, the company was at liberty to tear out the old cable road-bed and build the new electric tracks in the center.

Below Davis Street the yokes were left intact, being covered with bricks and other debris after the slot rails, main rails and paving blocks had been removed. Red rock as ballast was placed to a depth of eight inches on top of this debris filling, being thoroughly rolled before the ties were put in position.

MARKET AND SPEAR STS. NOVEMBER 20, 1907.

This red rock was the same previously described in connection with other work. As already noted, it had first been quarried and loaded by hand, put in connection with the large quantities necessary for this work, an electric shovel, as shown in one of the illustrations, was installed. This loaded a flat car with sixteen yards of rock in eleven minutes, breaking down most of its own rock, which was comparatively soft. The scoop has a capacity of three-quarter yards, and the shovel was constructed in the company's shops, using the derrick car as a basis. Lands End is five miles from lower Market Street, requiring a round trip of ten miles. In ten hours' time four cars, each taking sixteen yards at a trip, furnished 500 cubic yards of rock.

West of Davis Street, where the old grade was not so low, the tops of the yokes were cut off here and there where they interfered with placing the rails. The ties were laid between the yoke-uprights, which, with the concrete stringers used in all this work (previously described), gave practically a reinforced concrete construction that dynamite alone would remove. Grooved 9-inch rails, 141 lbs. to the yard, were used throughout, being tied and braced as already described. The usual form of basalt toothing and of asphalt paving completed the job. The four standard gauge tracks were laid on 12-foot centers, and paved two feet outside of either rail, giving a total width of 45 feet between Sansome Street and the Ferry. The two inner tracks were completed in twenty-five days working time. Incidentally the paving was finished one month before the city work was done. Its detail is better illustrated by the accompanying views than can be done by the writer's words.

The inner loop was put in when the two outer tracks were completed. As shown in the photographs and diagrams, this gives a double loop system as far out as Sutter and Sansome. Here it is that the main switching is done. Already plans have been made to put in a tower with compressed-air switch control at this point, although now the switching is done by hand. The Sutter, Haight, Eddy and Hayes Street cars take the outer loop, and the Castro, Valencia and McAllister, the inner, each line turning off from Market Street further out. Near the terminus it is provided with five cross-overs with lever switches, three on Market at Steuart St., and two at the neck of the loop, so that in emergency any car can be run onto any track. The sharpest curves have a radius of 42 feet 7½ inches, and with the tangents give a roughly elliptical area about 175 feet wide and 204 feet long. This is paved inside, one-half with basalt blocks on concrete, the other with asphalt.

MARKET AND SPEAR STS. DECEMBER 13, 1907.

The work thus far described practically concludes all electric construction completed by the United Railroads to date. East Street is being raised to grade, and the seven tracks handling the Mission and Folsom lines will be reduced to four. Market Street between Sansome and Twelfth is of the old construction, and must be rebuilt. In all, there are 220 miles of electric road in operation.

The cable roads have been replaced by electric wherever the grade was not prohibitive. It is of interest to note that there is probably no city in the world where electric cars are regularly operated over such steep hills as in San Francisco. Haight Street has grades of from 11 to 12 per cent, as has also Masonic Avenue. On Devisadero and on Fillmore there are grades of 14 per cent, while Sutter has one of 13.3 per cent. Two blocks on Fillmore have 24 and 25½ per cent respectively, but are operated with auxiliary cable and counter poise. On Twenty-fourth Street, one of the standard cars has recently been replaced by a smaller one on its 16 per cent grade.

But in the cable system of the Powell and Mason, Sacramento and Clay, and Washington and Jackson lines, the hills are so numerous and the grades so great, reaching 19.4 and even 19.7 per cent, that electricity is not feasible. Consequently, the power plant at Washington and Mason Streets has been rehabilitated, as shown in one of the pictures, and cable cars are now running on Jackson and Washington between Steiner and Powell, and thence to Market on Powell Street, which is in operation for its entire length, also on Powell and Mason between Market and Bay Streets. The Sacramento and Clay Street lines will

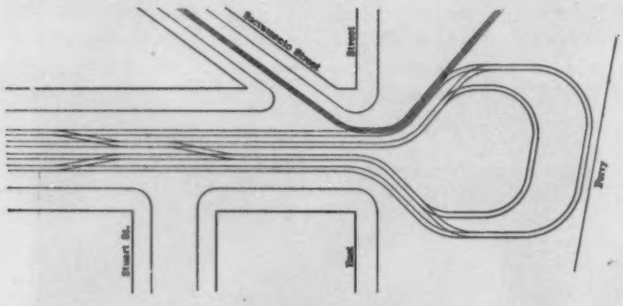


DIAGRAM OF FERRY LOOP.

soon be finished between Fillmore and the Ferries, all these streets being equipped with electric trolley west of Fillmore.

At Sacramento and Market Streets, the old "death curve," formerly passing within five feet of the curb, has been obviated by extending the cable track to meet the loop, and running the two together for a short distance, the cable branching off and completing the curve on East Street to Washington. This gives a distance of 17½ feet from the inner rail to the curb, as shown in the photographs and diagram. This is a pull curve, pulleys being placed between each yoke and allowing the cars to stop and start from any point, as the cable is always gripped. The cable track is of 3½ feet gauge, and is joined to the standard gauge electric so that but one crossing of the

TURK AND FILLMORE ST. SUB-STATION.

rails is necessary, and the short rail is not broken. The cars will run down Clay and out Sacramento, so as to run in the same direction as the electric cars on a part of the loop, a reversal of the former direction. This required that the Sacramento tracks between Hyde and Larkin Streets be shifted by means of hydraulic jacks, and another pull curve be put in at Larkin and Clay, and a full curve and crossing at Sacramento and Larkin.

The Castro Street line was all electrified excepting the 18 per cent grade on the Castro hill. This is surmounted by cable cars operated by a motor driven cable, operating between 18th and 26th Avenues.

The standard type of electric passenger cars are shown in several of the pictures, the United Railroads operating 600 in all. Their length over all is 45 feet 4 inches; width, 9 feet 3 inches, and height, 12 feet. They weigh from 28 to 29 tons, and are driven by four 50-horsepower General Electric direct current motors, with air brakes. They have a seating capacity of forty-four, with seats running lengthwise in the smoking compartment, and double reversible rattan seats and center aisle in the other. They can round a curve of 40 feet radius. They were built by the St. Louis Car Company, with Brill trucks, having 5-inch axle and 33-inch cast chilled wheels. In addition, the company has 47 repair, freight, derrick and other cars.

Temporary shops have been built at San Jose and Ocean Avenues, on the site originally bought for large shops capable of handling all equipment, and adequate for building the cars. A new car house is being built at 13th Avenue and H Street, and Fulton Street is being extended west

ELECTRIC SHOVEL.

along the north boundary of Golden Gate Park. The total cost of the reconstruction and rebuilding to date is estimated to be over eight million dollars.

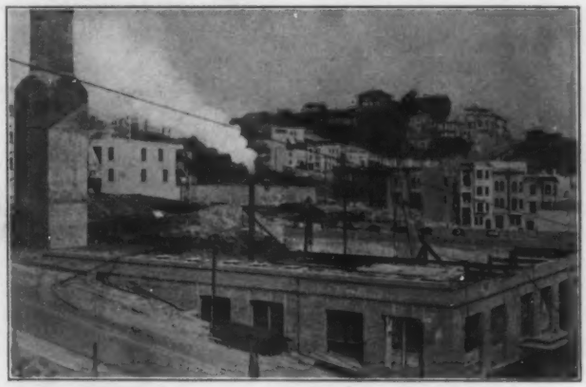
The United Railroads generates its own power at the Bryant Street and at the North Beach power houses, the former furnishing 3,200 kilowatts and the latter 4,800. It buys 6,000 kilowatts from the California Gas & Electric Corporation, which is supplied to the Bryant Street power house, and 4,000 kilowatts from the City Electric Company, transmitted from their North Beach 60-cycle plant to the frequency changer in the United Railroad's plant, where it is changed to 25 cycle. The equipment of the Bryant Street and the North Beach power houses has already been described in this journal, as have also the sub-stations at Turk and Fillmore, Geneva Avenue and Millbrae.*

The Turk and Fillmore sub-station has had 31 feet 6 inches added to its east end, and has been repaired, as shown in the accompanying picture, giving total length of 140 feet 6 inches, and a width of 45 feet. Two 1,500-kilowatt Westinghouse rotary converters have been installed, together with transformers and switchboards, supplementing the six 750 General Electric machines already installed. The Millbrae sub-station has been patched up, and is operating satisfactorily. The same is true of the San Jose and

*"Journal of Electricity, Power and Gas," July 14, 1906.

Geneva Avenue station. Its equipment is to be increased by another 750-kilowatt converter, giving a total capacity of 2,300 kilowatts.

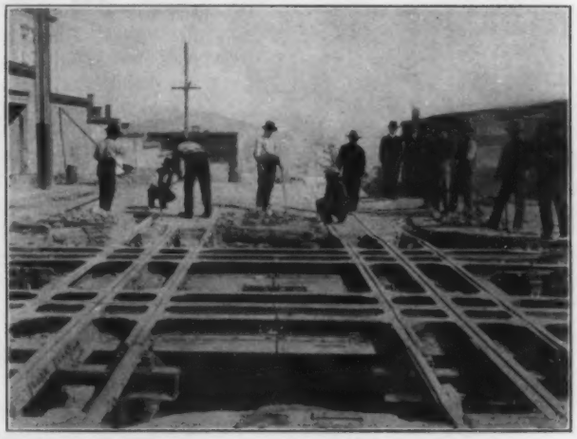
The 4,000-kilowatt frequency changer installed at the North Beach power plant by the United Railroads adds greatly to its former capacity of 4,800 kilowatts, which was repaired and put in operation soon after the fire. Plans have been drawn for a 5,000-kilowatt steam turbine installation to be added to this equipment at once. This will



WASHINGTON AND MASON ST. CABLE POWER HOUSE.

undoubtedly show better efficiency than the marine type reciprocating engines of the original installation.

The writer wishes to acknowledge his indebtedness to the various officials of the United Railroads for the information courteously furnished. The construction work is being carried on under the general supervision of General Manager Charles N. Black, and under the immediate direction of B. Peyton Legare, engineer of maintenance of way and construction for the United Railroads. The photographs were



CALIFORNIA AND POWELL CABLE CROSSING.

taken by J. H. Mentz, official photographer.

The history of the other street railway companies is similar to that already detailed, but on a much smaller scale. The power house of the Geary Street, Park and Ocean Railroad Company was beyond the fire zone, and cable cars were run as soon as permission to operate had been obtained, as the franchise had expired. Early in 1907 the California Street Cable Railway had rebuilt its burned power house, and had cars running on California, Hyde and Jones Streets. One of the pictures shows the cable crossing at California and Powell Streets.

The Union Street cable line has been electrified between Polk and Baker Streets to Harbor View and from the Ferry to Powell, buying its power from the United Railroads. The section between Powell and Larkin will be finished within a few months. One block with 19 per cent grade will require some safety device. Various girder rails, 85, 107 and 109 lbs., have been used in the reconstruction. The yokes were usually removed by hand, but in places the arms were cut so the rails could be laid to grade.

Thus concludes an important chapter in the industrial

SACRAMENTO AND MARKET CABLE CURVE.

history of San Francisco. It is characterized by a wonderful courage and a strong belief in the city's future, after the paralyzing effect of the world's greatest fire. We have avoided almost all reference to the various strikes and other hindrances occurring in this and all other of the city's great enterprises. They form another story, and are so recent and vivid as to require time from which to gain an unbiased perspective. These achievements in the face of great odds are a part of every engineer's life. To him they seem commonplace, by the world they have but scant recognition, to us it has been an unalloyed pleasure to record them.

CARE OF EXTRA TRAINMEN.

Santa Cruz, "The Atlantic City of the West," though a city of only about fifteen thousand inhabitants the year round, has between forty and fifty thousand people during a few months in the summer. Necessarily the Union Traction Company has to run a great many more cars in summer than in winter, thereby requiring a large force of conductors and motormen for the summer. S. W. Coleman, general manager of the company, who has had charge of the reconstruction of the Union Traction Company, one of John Martin's numerous electric enterprises, has adopted a novel scheme to hold his extra force of trainmen through the winter months, thereby insuring experienced and reliable men to run the extra cars in summer.

Most of the present extra trainmen worked all last summer, and when last fall came and the service was cut down, a section gang was formed consisting almost entirely of extra trainmen. At present this force of extra men is working with tamping bars, and in overalls, surfacing and lining the reconstructed track between Santa Cruz and Capitola. In this way the car men are given more or less steady work all the year round, and the company has a force of experienced trainmen equal to any emergency.

LABOR COST OF BUILDING A HIGH POWER TRANSMISSION LINE.*

A high power transmission line was to be run for about twenty miles. For all but 9,500 feet of this distance poles were up and being used for other purposes. For the distance named an entirely new line had to be built. This part of the line was along a public road. The poles and cross arms were delivered at one end of the line by railroad, so the average haul on material was about one mile. The poles were from thirty to thirty-three feet long, measuring from five to nine inches at the top and from twelve to eighteen inches at the butt.

The wages paid for a ten-hour day on the work were as follows:

Foreman	$3.00
Laborers	1.50
Linemen	2.50
Team two horses and driver	4.50

Hauling.—The poles were hauled on a two-horse wagon, one man assisting the driver in loading and unloading them. Naturally a large per cent of the cost of hauling was in taking the poles from the cars and unloading them from the wagon. The poles were of chestnut, fairly light, and eight to ten poles could be hauled at a trip. The cost of hauling the poles was:

Team	$22.50
Laborers	7.50
Total	$30.00

Digging Holes.—In digging the holes for the poles, one man worked on a hole. He used a digging bar, a shovel with extra long handle and a spoon with same length handle. The holes were dug five feet deep and were thirty inches in diameter at the top and about eighteen inches at the bottom, making an average diameter of two feet. From each hole was excavated 0.58 cubic yard. The material was a red, sandy clay, and the holes were all dry. There were seventy-four holes dug. The cost was:

Foreman	$17.25
Laborers	55.50
Total	$72.75

The cost per hole was as follows:

Foreman	$0.23
Men	0.75
Total	$0.98

The cost per cubic yard was as follows:

Foreman	$0.40
Men	1.30
Total	$1.70

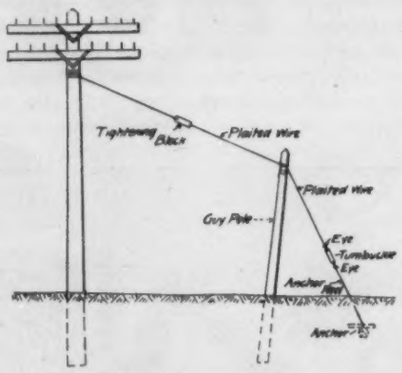
Raising Poles.—The pole raising was done by hand. A deadman and a jenny were used, these being manipulated by two men. The foreman or a lineman held a metal slide in the hole for the butt of the pole to slide against, keeping it from gouging ino the side of the hole. The rest of the crew used pikes to lift the top of the pole, and place it in the hole. The crew consisted of the foreman, one lineman and about seven men.

The method of operation was as follows: The pole was rolled to the hole by means of bars and cant hooks. The slide meantime was placed in the hole. Then the crew lifted the small end onto the jenny which held it until the deadman was put in place. With the pole resting on the deadman, the pikes were brought into play, and as the pole was lifted the deadman was moved up under the pole until the final lift came that sent the pole into the hole. Then it was turned and lined up, the lineman assisting the foreman in this work, after which the refilling of the hole was done.

*Engineering-Contracting.

A record of this work was kept in detail on a number of poles, from which it was found that the average time consumed in the work was as follows:

Getting ready to set pole, three minutes; raising pole, six



METHOD OF RAISING POLES.

minutes; lining pole, two minutes; filling and tamping earth in hole, one man shoveling and three tamping, ten minutes, several men standing by the pikes to steady the pikes; moving to the next hole, four minutes; total time, twenty-five minutes.

When everything is working well this average can be maintained, but a little time is occasionally lost due to unforeseen obstacles that prevent this speed. The cost of raising the poles was:

Foreman	$10.50
Laborers	37.50
Lineman	8.75
Total	$56.75

This, for the seventy-four poles, gives a cost per pole of the following:

Foreman	$0.14
Laborers	0.50
Lineman	0.12
Total	$0.76

Cross Arms.—Before raising the poles, and while the laborers were digging the holes, the linemen were at work dapping the poles to receive the cross arms. The cross arms used were eight-pin arms, two being placed on each pole. At all times in the line, double cross arms were used, that is, a cross arm was put on each side of the poles. This was the case for nine poles. For future needs the poles were dapped in three places. This made 240 daps necessary. The poles, as stated, were chestnut. The cost of dapping the poles was $22.62, making a cost per dap of 9.8 cents.

One lineman placed the cross arms, the team hauling them along as needed, and the driver acting as the lineman's "ground hog." The sketch shows how these arms were placed, and braced with two pieces of galvanized iron. In all, 166 cross arms were used. The cost of this work was:

Hauling with team	$21.37
Lineman	6.25
Total	$27.62

The high cost of this was due to the fact that the team was charged to this work for the entire time of placing the cross arms, as it waited at each pole while the arms were being put in place. The cost per cross arm was 17 cents.

One lineman and a helper placed the insulators. The cost of this was:

Lineman	$3.75
Helper	2.25
Total	$6.00

Only six insulators were put on a cross arm, thus making 12 to a pole, except at the turns, as the line was to carry 12 wires. In all 996 insulators were used, hence the cost per unit was 0.6 cents.

Guy Poles.—In building lines with a number of wires on them, it is necessary to guy all poles where there are turns in the line, and on long straight lines some of the poles must also be guyed. The sketch shows the method used in guying this line, and is one frequently used. The guy pole holes were dug of about the same dimensions as the holes for the line poles.

The cost was:

Foreman	$1.50
Laborers	6.75
Total	$8.25

The cost per hole was:

Foreman	$0.17
Laborers	0.75
Total	$0.92

The raising of the poles cost:

Foreman	$3.00
Laborers	9.00
Total	$12.00

This makes a cost per pole of $1.33. This is large, owing to the fact that the men lost considerable time moving from pole to pole and carrying their tools, also to the fact that each pole had to be cut and trimmed, as these guy poles were made from rejected line poles.

The method of placing the guy wires to the poles was as follows: The wire was fastened to each of the two poles, and then brought to the tightening block as shown in the sketch. With blocks and tackle fastened to the two poles, the poles were brought to a snug bearing and the wires were made fast around the tightening block, shown in the sketch. The wires go around the block in grooves made for the purpose at right angles to each other. While the linemen and their helpers are doing this work, the laborers are digging the anchor hole and placing the anchor rod. To this is fastened a turn buckle, and a wire is run from the guy pole to the turn buckle. The blocks and tackle are then fastened to a handy tree or stump, or, if necessary, to the anchor rod and the guy pole is pulled back, tightening the guy wire between the two poles, while the turn buckle is screwed up, thus making all the guy wires taut. At times, instead of making an anchor as shown, the anchor wire can be fastened to a convenient tree. Both kinds of anchors were used in this case. The cost of this work was:

Foreman	$1.50
Linemen	3.75
Laborers	3.75
Total	$9.00

This made a cost of $1.00 per pole, making a total cost per guy pole of $3.25.

About one-half of this line ran through the edge of woods or by shade trees. A few trees had to be cut down and a number trimmed; some tall bushes were also cut down. The foreman looked after this work part of one day when all his force was at work upon it, but for the most part linemen were in charge of several laborers doing this work. The cost of it was as follows:

Foreman	$ 2.25
Lineman	18.12
Men	13.13
Total	$33.50

Stringing the Wires.—As previously stated, 12 wires were strung on the poles. The wires were light weight. The team hauled the wire, and one horse was used in helping to string it, the other horse standing idle. In line work, a team is nearly always necessary, yet there are times that it may stand idle for hours, thus increasing the cost of that item to which it is charged. When there is nothing else for the wagon to do it is used to carry the tools along the line as the men work. In stringing the wire the horse pulled a rope fastened to two strands of wire at one time, thus running out two wires, and making six trips of the horse to string out the 12 wires. For this work 3 linemen were used, but in fastening the wires to the insulators only 2 linemen were used, and the wires were pulled tight by the helpers with blocks and tackle. The cost was:

Foreman	$ 18.00
Linemen	37.50
Laborers	27.00
Team	36.00
Total	$118.50

In all, 21.6 miles of wire were strung, and this made a cost of $16.50 per mile of wire.

Changing Poles.—At the ends of the line where connections were made with the old line of poles, some poles had to be changed to make them suitable for the new service. There were 3 of these at one end, and 1 at the other. The work consisted in taking down the old poles and putting in their place poles from 40 to 50 feet long. Cross-arms had to be put on the new poles, and the wires changed over to the new poles. It took a half day for the crew to do each pole, thus spending 2 days on the 4 poles. The cost of this was:

Foreman	$ 6.00
Lineman	2.50
Laborers	39.00
Team	9.00
Total	$56.50

This gave a cost per pole of $14.12. In line work the foreman is always a lineman, and in doing odd jobs this frequently keeps the cost down, as he will often do work that a lineman is called upon to do. As the lineman is the higher priced man he should be allowed to do only such work as the helper is not able to do.

Total Cost.—The total cost of the entire work was as follows:

Hauling	$ 30.00
Digging Holes	72.75
Raising Poles	56.75
Dapping Cross-Arms	22.62
Placing Cross-Arms and Insulators	33.62
Guy Poles	29.25
Trimming Trees and Bushes	33.50
Stringing and Fastening Wires	118.50
Changing Old Poles	56.50
Total	$453.49

There being 1.6 miles of line built, the cost per mile for each item was:

Hauling	$ 18.75
Digging Holes	45.47
Raising Poles	35.47
Dapping Cross-Arms	14.14
Placing Cross-Arms and Insulators	21.01
Guy Poles	18.28
Trimming Trees and Bushes	20.94
Stringing and Fastening Wires	74.06
Changing Old Poles	35.31
Total	$283.43

For the 74 new poles erected this makes a cost per pole for the completed line of $6.13.

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VOL. XX FEBRUARY 22, 1908 No. 8

EDITORIAL.

GAS RATES.

The intimate connection that exists between the subjects of public control of public utilities and that of municipal ownership is exemplified in the plea of the San Francisco Gas & Electric Company, before the Board of Supervisors of San Francisco, that the rate charged for gas be raised from eighty cents to one dollar per thousand feet. This company manufactures a petroleum-enriched water-gas at an actual present cost of 75½ cents per thousand cubic feet, exclusive of bond interest and sinking fund. During 1907, 2,528,767,400 cubic feet of gas gave gross receipts of $0.8166 per thousand, thus giving $155,431.14 to take care of the bond interest and sinking fund of $381,932, as well as pay dividends on an estimated value of $17,894,173.27, or an assessed value of $3,739,221, which, allowing the usual assessing percentage, represents $7,609,800, a feat apparently impossible of accomplishment, especially when the further item of depreciation is considered.

Rates are to be fixed for the years 1908-9, before the first of March, and in summarizing probable conditions, General Manager John A. Britton states that oil, representing one-third of the total cost of the gas, will advance July 1, 1908, 25 cents per barrel, making an added cost of 6¼ cents per thousand. Interest at 7 per cent and depreciation at 5 per cent add .34¼ cents to this, a total of $1.18.

In accordance with these figures which we quote from the argument presented to the Board of Supervisors, no public service corporation could long hold out from municipal ownership. The company has given permission to have its plants and books examined to verify its figures. If the findings of a commission appointed for this purpose are in accord with the figures indicated, equity can suggest but one answer to the question of increasing the rate. Our comment is superfluous.

STEAM ENGINE VS. PRODUCER-GAS ENGINE.

Conservation is no more important than correct utilization, nor is there any other saving factor as great. In this particular, how little has modern man progressed beyond the ancient Greek with his Prometheus-stolen fire brand for light and heat! Our best reciprocating steam engines use but five per cent of the total energy available, though by the use of superheated steam in the steam turbine, this has been somewhat increased. In the United States, coal is being used at the rate of over 400,000,000 tons per year, and over 126,000,000 barrels of petroleum are consumed annually. A halt may yet be called in this wastefulness.

In the fuel tests conducted by the United States Geological Survey, comparison was made of the relative economies of steam and gas power plants in the conversion of one pound of coal containing 12,500 British Thermal Units. The result is expressed tabularly:

	Steam Power		Gas Power	
	B.T.U.	Percent	B.T.U	Perc't
Losses in exhaust, friction, etc.	11,892	95.14	10,812	86.5
Converted into electric energy	608	4.86	1,688	13.5
	12,500	100.	12,500	100.

The results indicated fulfil the intention of showing the greater efficiency of a producer-gas engine as compared with a reciprocating steam engine. Many low-grade fuels which give poor results under steam boilers are satisfactory in the gas producer. Thus is opened up the industrial development of hitherto waste lands. The report further shows the reliability and cheap running of gas engines in experienced hands, and indicates the future centralization of power development. But how puny and insignificant will these efficiencies appear in the future, when Science has solved the problem of the rational utilization of low-grade fuels and of the burning of coal without smoke, by the substitution of some source of power beyond our ken.

REMOVAL NOTICES.

The Weidenthal-Gosliner Electric Works expects to be established at Mission and New Montgomery Streets, before the 1st of March.

The Armstrong-Kreling Machinery Co. has moved to 564 Howard Street, from 88 Second Street, San Francisco.

The Bryant Electric Company will have permanent quarters at Second and Mission Streets, San Francisco, moving from Oakland.

THE JOHN W. MACKAY JUNIOR FELLOWSHIPS.

In July, 1906, Mr. Clarence W. Mackay, jointly with his mother, Mrs. John W. Mackay, gave to the University of California one hundred thousand dollars, for the endowment of the John W. Mackay Junior Professorship of Electrical Engineering, with the proviso that such part of the income as the Regents of the University might determine, or the whole, was to be used for the salary of the incumbent of the chair, and that the residue of the income was to be devoted to the furtherance of research work in electrical engineering in the University.

In accordance with the terms of this endowment, the University of California has established two John W. Mackay Junior Fellowships in Electrical Engineering, of an annual value of six hundred dollars each. The tuition charges of the University are nominal. These fellowships are open to all properly qualified university graduates.

The object of the fellowships is not to facilitate ordinary engineering or scientific study, but to enable students who have completed a college course to do research work in electrical engineering, with a view to aiding the advance of the application of electricity to scientific and industrial purposes.

The place of residence of those holding the fellowships is to be at the University of California. Experimental or other work, however, may be carried on outside the laboratories of the University.

Opportunities for study and investigation in Electrical Engineering at the University of California are extensive, and the laboratories are well equipped for investigation and research work. The appointment to each fellowship shall be for one year, which appointment may, however, be renewed, at the discretion of the Graduate Council of the University.

Applications for these fellowships should be filed with the Recorder of the Faculties as early as March 15th, if possible.

For announcement of the courses and details of the work in Electrical Engineering and related subjects, and for application blanks, etc., address

THE RECORDER OF THE FACULTIES,
University of California, Berkeley, California.

TRADE CATALOGUES.

Monthly bulletin from the Ohio Brass Co., in addition to the usual notes, contains an account of Porcelain Insulator Testing and Third Rail Insulators for Industrial Railways.

Habirshaw Wire Co., of Yonkers, N. Y., sent an interesting reprint on "Rubber Insulation for Conductors," by Fred J. Hall, which tells some important, but little known, facts about rubber. It is well worth reading.

The General Electric Company, Schenectady, N. Y., describes an improved type of switch indicator known as the SI-104, in Bulletin No. 4563. Low pressure air compressors rated from .88 pound to 4 pounds per square inch and from capacities of 750 to 10,000 cubic feet of free air per minute are included in the line of centrifugal air compressors described in Bulletin No. 4564. These machines are similar to the well-known centrifugal pump in both appearance and operation, and consist essentially of a rotating impeller surrounded by a suitable casing with an intake opening at the center and a discharge opening at the circumference. In Bulletin No. 4544 is described the present design of switchboards for railway use. The following types are described: Generator panels including circuit breakers and equalizer switch panels, rotary converter panels, feeder panels for one circuit, feeder panels for two circuits with one ammeter per panel, and feeder panels for two circuits with two ammeters per panel. The various forms of apparatus used in connection with the panels, details of construction, etc., are described and illustrated, and complete tables giving catalogue numbers, capacities, etc., and dimension sketches, are given. A line of panels for small plant work of this character is described in Bulletin No. 4558.

PUBLICATIONS RECEIVED.

The U. S. Geological Survey sends a preliminary report by D. F. Randall on "The Burning of Coal Without Smoke in Boiler Plants," to which is attached a bibliography of the subject. The prevention of smoke is considered under the heads of feasibility, the principles of smokeless combustion, proper furnace equipment, difficulty in securing perfect combustion and indirect methods of smoke abatement.

In a recent bulletin issued by the U. S. Geological Survey is included an account by Mr. Robert H. Fernald of the present status of the producer-gas power plant in the United States. The greater portion of the contents is given up to a report of tests on producer gas made at the government test plant in St. Louis. His conclusion is that the situation seems to be favorable to the producer-gas plant, not only as to cost of installation, operation and maintenance, but also as to reliability.

The University of Wisconsin, of Madison, Wisconsin, sends some valuable bulletins from its engineering departments. No. 157 makes "A Comparison of the Effects or Frequency on the Light of Incandescent and Nernst Lamps," by F. W. Huels. No. 173 is "Investigations of Centrifugal Pumps," by C. B. Stewart, and No. 175 describes "Tests on Plain and Reinforced Concrete," by M. O. Withey.

"Mineral Resources of the United States for 1906" contains a statement of the production of mineral substances and the chief features of mining progress as collected by the U. S. Geological Survey. The book is divided into chapters, each of which treats of a separate industry. This volume maintains the high standard set for the past twenty-five years. It is sent free of charge to those interested.

"A Compilation of the Records of the Colorado Springs Lighting Controversy," by Henry Floy, published by "Illuminating Engineering Publishing Co.," 12 West Fortieth Street, New York City. The controversy between the City of Colorado Springs and the Pikes Peak Hydro-Electric Company has become memorable because it decided for the first time in a judicial way the meaning of the phrase "An arc light of standard 2,000 candlepower," the monetary damage accruing by the substitution of a 6.6 ampere series a. c. arc lamp for the above, and the financial damage resulting from the failure to maintain the substituted lamps at their normal operating conditions. Its complete history and details are here presented in compact form.

PERSONAL.

Tom C. Walsh, of the sales department of the Deveau Telephone Manufacturing Co., Brooklyn, N. Y., has been in San Francisco.

F. C. Finkle, consulting engineer, announces the removal of his office from the Edison Building to rooms 230-231 I. W. Hellman Building, Los Angeles, Cal.

R. S. Masson, chief engineer of the Electric Operating Construction Co., of 805 Union Trust Building, San Francisco, is at Prescott, Ariz., directing the work of the Arizona Power Company, a 7,500 horsepower water power development near Prescott, Ariz., the same having been recently financed. William P. Bonbright & Co., 24 Broad Street, New York, act as fiscal agents, and Viele, Blackwell & Buck are the consulting engineers.

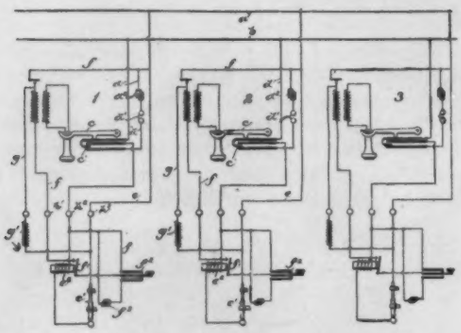
MEETING NOTICES.

A meeting of the New England section of the Illuminating Engineering Society was held in Boston, Mass., February 18th. L. W. Marsh read a paper on "Daylight Illumination."

PATENTS

LOCK-OUT DEVICE FOR PARTY-LINE TELEPHONES. 877,901. William M. Bruce, Jr., Springfield, Ohio, assignor to the American Automatic Telephone Company, Rochester, N. Y.

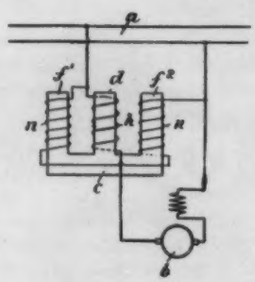
In a common battery line telephone system, an electro-magnet at each subscriber's station means for bridging the same across the line, a normally open shunt around the said



electro-magnet including the subscriber's talking instruments, and a circuit closer in said shunt adapted to be operated by said relay, and a second shunt having permanent resistance around said talking instrument, the resistance of said second shunt and the relay being such as to utilize the current from the central energy, and prevent any other relay on the line from being operated.

MAGNET FOR ALTERNATING CURRENTS. 878,402. Christian Kramer, Frankfort-on-the-Main, Germany, assignor to Felton & Guilleaume Lahmeyerwerke Actien-Gesellschaft, Frankfort-on-the-Main, Germany.

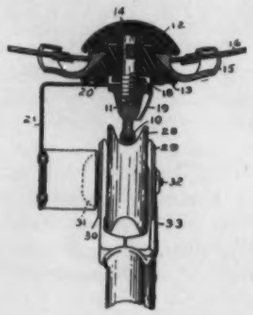
The combination with a source of single phase alternating current of an electro magnet comprising a core consisting of



three parallel pole pieces and a yoke connecting the same, and windings upon pole pieces, the winding upon one of pole pieces being connected in series across source with a substantially non-phase displacing, current-reducing means, the windings upon the other two pole pieces being connected in series across scurce.

OVERHEAD ELECTRIC CONTACT. 878,247. Thomas W. Small, Cleveland, Ohio, assignor to the Acme Automatic Street Indicating Company, Cleveland, Ohio.

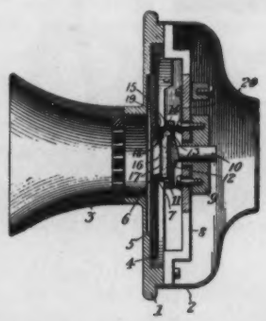
The combination with a trolley harp carrying at its side



a contact boss, and a contact making device presenting to such boss a plurality of flexible contacts arranged to bend in the direction in which the trolley is moving.

TELEPHONE-TRANSMITTER. 878,192. William W Dean, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio.

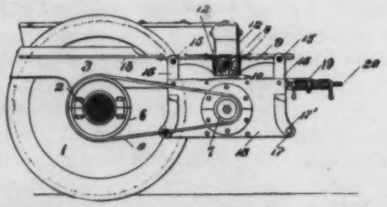
In a telephone transmitter, a cup containing granular material, a diaphragm having a stiffening rib or flange, and an



electrode carried by said cup and intraperipherally engaged by said flange, said electrode receiving motion transmitted directly from the diaphragm through said flange.

MEANS FOR MOUNTING AND DRIVING DYNAMOS FOR ELECTRIC-CAR LIGHTING. 878,305. Alexander McGary and John W. Jepson, New York, N. Y., assignors to Bliss Electric Car Lighting Company, Milwaukee, Wis.

Means for mounting a dynamo upon a car or other vehicle, comprising the end sill or beam of the car truck, a saddle plate



mounted upon said sill or beam and formed with a recess, the sides of which are adapted to embrace said beam, supporting links or members pivotally connected to said saddle plate on opposite sides of said plate, a dynamo machine carried by members, and driving connection between a car wheel or axle and the dynamo.

INDUSTRIAL

THE WESTINGHOUSE ELECTRICALLY HEATED SAD IRON.

There is perhaps no form of electrical apparatus that appeals to the housekeeper more strongly than does the electrically heated sad iron. Every household has its ironing and pressing to be done, and the older method of doing the work involves many unpleasant conditions, whether the work is done by a domestic or by a member of the family, from which the housekeeper is glad to be freed. Its universal adoption depends only upon the efficiency and durability of the iron. These two points are prominent in the iron that the Westinghouse Electric and Manufacturing Company is now placing on the market.

In form the Westinghouse electric iron differs only from an ordinary iron in its more symmetrical and attractive appearance, and in being provided with terminals and a flexible cord through which the current is transmitted. In operation it elevates ironing from drudgery to a comfortable and pleasant task. Its heating mechanism, which is entirely concealed, keeps the iron at the proper temperature at a minimum consumption

of current. It consists of a flat insulated resistance strip clamped by hydraulic pressure between two flat iron plates, forming a solid heating element of high thermal conductivity, and having a large heat storage capacity.

The design of the element is such that the heat is evenly distributed over the entire bottom of the iron, the edges and point being practically the same temperature as the middle of the bottom. A non-conducting element is used between the top of the iron and the heating unit. This construction results in the top of the iron being cooler than its face. The heating unit is hermetically sealed in its insulation, and cannot, therefore, deteriorate any faster than the iron, as it is not subject to the oxidizing effects caused by contact with air.

The iron is extremely simple, and there is absolutely nothing to get out of order or to require renewal. Irons which have been in use continually for the past six years, without costing a cent for repairs, are in as good condition today as ever. In fact, the electrical construction is so simple and durable that there is no reason why it should not last as long as the iron itself.

The terminals are protected by a solid metal guard, and the cord leading from them is securely anchored by a clamp on the handle of the iron. A wire spring which surrounds the cord at this point, prevents any sharp bends. A separable plug is provided by which the iron can be connected to any convenient lamp socket without twisting. A small spring attached to the cord takes up all slack, and so keeps it from dragging on the clothes or getting in the way of the operator.

The polishing surface of the iron is of highly polished cast iron, found by experience to be the most satisfactory surface for the purpose. The upper portions of the iron have a burnished nickel plate surface. The handle is of ebonized wood, heat proof and unbreakable. A heat proof stand, upon which the iron should be set when not in use, is provided with every iron.

The irons are made to suit all commercial lighting circuits, and can be used on either alternating or direct current with equally satisfactory results.

TECHNICAL PUBLICITY ASSOCIATION.

R. F. Bieber, president of the 1900 Washer Company, and W. H. Ingersoll, advertising manager of the National Cigar Stands, made addresses at a well attended meeting of the Technical Publicity Association in New York on the evening of January 30th. The speakers held to the topic of the evening, "Mail Order Advertising," and those attending joined in a general discussion of the subject. Members present represented: A. Allan & Son, N. Y.; John A. Roeblings Sons Co., Trenton, N. J.; Yale & Towne Manufacturing Co., N. Y.; Lidgerwood Manufacturing Co., N. Y.; Sprague Electric Co., N. Y.; R. R. Almond Manufacturing Co., Brooklyn, N. Y.; General Electric Co., Schenectady, N. Y.; Crocker-Wheeler Company, Ampere, N. J.; American Locomotive Co., N. Y.; A. S. Cameron Steam Pump Works, N. Y.; American Brake, Shoe and Foundry Co., N. Y.; N. Y. Telephone Co., N. Y.; Westinghouse Co., of Pittsburg, Pa.; N. Y. Edison Co., N. Y.; J. G. White & Co., N. Y.; Chas. A. Schieren & Co., N. Y.; M. H. Treadwell Co., N. Y.; Jos. Dixon Crucible Co., Jersey City, N. J.; American Goetze Gasket and Packing Co., N. Y.

HYDRO ELECTRIC PLANT FOR TOKIO, JAPAN.

The first 60,000-volt hydro-electric plant in Japan has just been put into service with signal success after having passed the rigid inspection which is required by the Japanese Government of all electrical installations. Power is obtained by impounding the Ugigawa River, a narrow and swift but deep river, such as is often found in the mountainous portions of the Flowery Kingdom. The normal capacity of the main station is 18,000 kilowatts, and is furnished by six 3,000-kilowatt, 50-cycle, 6,600-volt water wheel driven alternators.

The generator voltage is stepped up to the line voltage of 60,000 volts through three banks of three each single phase water-cooled 2,000 kilowatt transformers, at which potential it is transmitted 25 miles to Waseda sub-station, just outside the city of Tokio. In this main sub-station water-cooled transformers of 1,800 kilowatts each step down the line voltage to 11,000 volts, at which potential it is transmitted underground through lead armored cables to eleven distributing sub-stations situated in various parts of the city.

In each of these smaller sub-stations oil-cooled transformers of 250-kilowatts capacity step the voltage down to 2000 volts, the line potential of the city circuits. The territory immediately surrounding the Waseda sub-station is also fed with low voltage current for light and power purposes.

The entire transformer, regulating and controlling equipment consisting of eighteen water-cooled and fifty-four oil-cooled transformers, eighty-one single phase induction feeder regulators and 149 switchboard panels was furnished by the General Electric Company, as was also the lead armored cable.

INCREASING USE OF ELECTRICAL APPLIANCES IN KOREA.

Consul-General Thomas Sammons, of Seoul, furnishes the following information concerning Korea as a market for electrical appliances, fans, and motors:

The Koreans, having discovered the service and comfort afforded by electrical power and lighting, are rapidly installing small motors in their shops and lights in the homes at Seoul. The modern Korean palace has been lighted for some time by electricity, and of late commercial plants have been established at Chemulpo and Fusan, while two plants, under one management, supply light and power to Seoul, the capital.

The Seoul plant, which furnishes light for commercial purposes and power for electric tram lines, has recently been enlarged until its capacity is almost doubled, and further improvements are contemplated. This plant formerly furnished light from the tram-car current mains, but the result of the varying direct current, under this system, gave unsatisfactory lighting facilities. Therefore, a new and improved plant, furnishing an alternating current of 100 volts, 60 cycles, and 7,200 alternations, was installed.

Attracted by the improved quality of the light furnished by the new system, many Koreans are installing electric lights in their homes. The company controlling this plant has been rushed of late with orders for three and four light wiring. The company installs fixtures of a standard nature, charging a monthly rental for these in addition to the regular current charges. This company, therefore, is steadily importing and installing American fixtures. The current supplied in Seoul is steam generated by engines of a modern nature. Of late this company has been installing for the Koreans many small motors, capable of running rice mills and other light machinery. The electric motor is a great novelty to the Koreans, who seem greatly pleased with it, and quick to see its advantages. The Koreans are reported as well pleased with the results obtained from the use of the motors and electric lights, and, consequently, the company supplying this trade is on the market for many and various electrical fixtures.

It is believed that electrical fans will be used in Korea as soon as the natives able to purchase them become accustomed to the various uses of electricity. It was some time before the Koreans began to enjoy electric car rides, and it is also believed that they are only beginning to show their appreciation of modern electrical improvements.

The American-Korean Electric Company, of Seoul, intends to introduce fans extensively during next summer, and electric flatirons, warming pads, and other novelties will probably follow in due course. The steady market demand at present, however, is limited to motors and fixtures. On account of the power companies' method of installing fixtures and then renting them to the consumers, there are no stores in Korea carrying exclusive stocks of electrical fixtures and furnishings, as is the case in the United States. The power companies import the bulk of these supplies direct.

The Oriental Consolidated Mining Company, operating at Unsan, has recently installed a modern and complete turbine electrical generating plant, capable of operating their stamp-mill machinery and mine hoists. Water is carried from a reservoir, with 111,599,231 cubic feet of available water, through a flume to the power house. This company is using American electrical materials exclusively, and is at present enlarging the scope of its plant.

The electrical companies at Fusan and Chemulpo supply only current for electric lighting purposes and install appropriate fixtures, while the small plant supplying light to the imperial palace at Seoul operates but a few hundred lights. The Chemulpo company may be said to confine its material and supply accounts largely to German markets or German business connections.

The Korean duty on imports of this nature is 7 per cent, with no limit to the size of packages.

Shipments can be made to Kobe or Nagasaki, Japan, Kobe being preferable, thence to Chemulpo, the port of Seoul. Rates from Japan to Chemulpo, $3.98 gold per ton.

ANNUAL DINNER OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The annual dinner of the American Institute of Electrical Engineers will be held at the Waldorf-Astoria, Fifth Avenue and Thirty-fourth Street, New York City, on the evening of Wednesday, February 19, at 7 o'clock. Carrying out the idea established upon former occasions, the feature of the dinner this year will be the tribute rendered by the speakers to the relation of the electrical engineer with public-service corporations. The occasion will be designated as the "Public Service Dinner," and among the speakers who have promised responses to toasts are many men prominently identified with public-service utilities, either as members of commissions or operating heads of large utilities organizations. The price of the dinner will be $5, not including wine or cigars. As usual, ladies will be present. Guests will be seated at small tables accommodating eight persons. The dinner committee is composed of Robert T. Lozier, chairman; A. A. Gray, Frederick C. Bates and George H. Guy.

CONVENTION OF BRANCH MANAGERS OF THE H. W. JOHNS-MANVILLE CO.

In accordance with their usual custom, the H. W. Johns-Manville Co. held a convention of its branch managers, in New York, from January 29th to February 1st. The managers of the various branches of the company throughout the United States were present at the meeting, and a general discussion of the business affairs of the company took place. As a fitting wind-up of the convention, a banquet was given to the managers, at the Union League Club, on Friday evening, January 31st. The convention was pronounced a decided success by all present.

The General Electric Company is furnishing the entire electrical equipment for the Tajo mines, in the Rosario district of Mexico. The order includes a three-phase, 60-cycle, 2,300-volt revolving field generator of 150 kilowatts capacity, 9 oil-cooled, type H transformers, three 440-volt, form K, induction motors, of 15, 35 and 75 horsepower capacity, with starting compensators, 2-circuit feeder panel, complete lightning arrester equipment, and the necessary supplies of wire, insulators, etc.

"Sound Waves," published at Chicago, Ill., has been sold to the McGraw Publishing Company, of New York City, who will consolidate it with the "American Telephone Journal." The February issue will appear in the form of the consolidated paper.

The United States Civil Service Commission announces an examination on March 25, 1908, to secure eligibles to fill a vacancy in the position of draftsman, qualified in engineering construction and supervision of plumbing installation, at $6 per diem when actually employed, Immigration Service, Ellis Island, N. Y., and vacancies requiring similar qualifications as they may occur in any branch of the service.

The examination will consist of architectural engineering, plumbing work and installation, and training and experience.

NEWS NOTES

ILLUMINATION.

Long Beach, Cal.—The Long Beach Asbestos Company will sink a sixteen-inch well at once to a depth of 400 feet to develop a further gas supply.

Petaluma, Cal.—A committee has been appointed to look to the advisability of building a municipal gas plant and erecting a municipal rock crusher and to ascertain the cost.

Lakeport, Cal.—In the matter of the deal between the Lake County Electric Power Company and the owners of the Kelseyville gas wells for the purchase of their property, the purchase price had been agreed upon, but the time of payments had been left open and they failed to agree on this point. The company is going ahead with its work, and will procure its power from another source.

Guadalajara, Mexico.—A Mexican capitalist, who last year secured a concession from the government for establishment of a gas plant at Guadalajara, states that he will have a gas manufacturing plant in operation within a year. Oil will be the fuel. H. N. Sessions of Los Angeles has arrived to prepare the plans for the plant and mains. An effort will be made to secure oil from either the Mexican Petroleum Company or the Pearson interests.

San Francisco, Cal.—John A. Britton, president of the Pacific Gas & Electric Company, appeared before the Supervisors last week and asked that the Board fix new gas rates at $1 per thousand. Edward C. Jones, chief engineer of the gas company, produced a carefully prepared chart which dealt with the cost of making gas, its various processes, losses by leakage and cost of labor. He maintained that the company paid the highest wages in the world to gas-makers and worked them shorter hours than any other like corporation. According to Mr. Britton, the revenues derived from the sale of gas during the year just closed amounted to $2,291,672.39. The company's loss, he said, was something more than $250,000. Britton swore that the original cost of the gas plants was $16,809,639.88. During the recent calamity the company suffered a loss of $4,500,000, and recently it was forced to levy an assessment of $10 on each share of stock in order that current debts and losses might be met. Britton said that the outstanding capital of the corporation was $15,794,284.36; outstanding bonds, $8,800,000, and the net amount of floating debt $1,998,436.82.

TELEPHONE AND TELEGRAPH.

Merced, Cal.—Permission has been granted by the Board of Supervisors to the Hayes Company to erect a private telephone line from the Sheehy ranch to Athlone.

Bakersfield, Cal.—Permission has been granted to R. E. Galloway for the construction of a telephone line along the newly surveyed county road between McKittrick and Sunset.

Santa Rosa, Cal.—The Magnolia Telephone Company has been incorporated with a capital stock of $10,000. The directors are D. M. Winans, T. C. King, G. B. Robinson, Jas. W. George and Diedrich Rangers.

San Francisco, Cal.—The promoters of the Colusa County Telephone Company, consisting of residents of Glenn and Colusa Counties, have incorporated the Glenn County Telephone Company, and propose to install a system throughout the county of Glenn, similar to the one already installed in Colusa County.

San Francisco, Cal.—The Home Telephone Company plans to erect a six-story office building on the northwest corner of Grant Avenue and Harlan Place, and have made application through the Empire Construction Company, which is to build the structure, for the necessary permit. The estimated cost of the building is $175,000. The material used will be reinforced concrete.

WATERWORKS.

Roswell, New Mexico.—Prominent business men of Roswell are endorsing the proposed bond issue for putting in an additional water system and sewers, amounting in cost to $155,000.

Los Angeles, Cal.—Ten miles of water mains will be laid immediately at Monte Vista by Emil Firth, who has let the contract for the work. The waterworks and irrigation plant will cost $75,000.

Gilroy, Cal.—At the last meeting of the Common Council it was resolved that immediate steps should be taken to replace the water pipes on all the streets of Gilroy with larger and better pipe.

Redlands, Cal.—The Lugonia Park Water Company has completed arrangements for remodeling its water system, the work to be begun this spring. A cement lined reservoir will be constructed and new lines laid.

Lovelock, Nev.—The petition to the County Commissioners of the Mazuma Light & Power Company, asking permission to lay water mains in the town of Mazuma, has been granted. The work of laying the pipe will be commenced at once.

Selma, Cal.—E. B. Walthall, of the San Joaquin Light & Power Company, announced that his company had spent over $6,000 in improvements in Selma and expects to lay larger mains and new ones involving a larger expenditure in the next year.

Port Townsend, Wash.—McInnis & Harrington were the successful bidders on the construction of the Government water system at Seward, Alaska, at $69,518.36. Work consists of building a concrete reservoir, laying about fifteen miles of pipe, etc.

San Diego, Cal.—A petition for laying 600 feet of six-inch water mains in University east from Thirtieth and University, has been referred to the superintendent of the water department by the Board of Works. Another petition is pending contemplating a longer extension of the water main.

Riverside, Cal.—The Board of Directors of Corona will install a pumping plant to be operated by electricity at the corner of Ontario and Lemon Streets, the power to be supplied from the company's pumping station at Ethanac. A new line of 3600 feet will be laid, which calls for twelve-inch steel pipe. The pump will have a capacity for 100 inches.

Alameda, Cal.—The attention of the City Council has been called to the proposition of laying a water main on Webster Street to protect the warehouse district. The estimated cost is $5,000, and the water company has offered to pay half the cost. No definite action will be taken until President Titus of the water company returns from Seattle.

TRANSPORTATION.

Salt Lake City, Utah.—An ordinance has been passed granting an electric railroad franchise to the Emigrant Canyon Railway Company.

Oakland, Cal.—Guy C. Earl, vice-president of the Great Western Power Company, says that the Western Pacific is now perfecting its plans for the electrification of its system.

San Diego, Cal.—The City Council has adopted Concurrent Resolution 101, granting to the San Diego Electric Railway Company a franchise for a street railway along certain streets.

San Jose, Cal.—L. E. Hanchett, president and general manager of the San Jose & Santa Clara Railway Company, will open an office in San Francisco the first of next week. Mr. Hanchett will continue to reside in San Jose.

San Francisco, Cal.—Steps to procure 2,000 signatures to a petition to be presented to the Board of Supervisors to emphasize a plea for an electric trolley line in Pacific Avenue, have been taken by members of the Western Addition Improvement Club.

Reno, Nev.—Contractor Lund of this place states that he has been negotiating with a number of Reno capitalists in regard to a contract for the building of an electric railroad from Reno to Lake Tahoe and that he expects the contract to be signed up in a few days.

Perris, Cal.—The Simmen Automatic Railway Signal Company will remove its shops from Los Angeles to Perris within a few days. Extensive tests of the equipment are to be made by the Santa Fe Railroad, which will install the wires along its line and the Simmen Company will install and operate the system.

Redding, Cal.—George Springer, right-of-way man for the Northern Electric Company, is authority for the statement that the company has accepted the surveys for an extension of the line from Chico northward through Red Bluff and Redding to Kennett. The route has been fully decided upon, and the work of securing the right of way from property owners will be undertaken at once.

OIL.

Goldfield, Nev.—Louis Bond has returned to Goldfield from Mono Lake, Cal., and reports that oil has been struck on the shores of that lake. A company has been formed to drill wells there, and if a large flow of oil is encountered, the oil will be piped a distance of nearly 100 miles to this city.

Newport, Cal.—Pumping is being done on well No. 1 on the mesa. The result is about ten per cent of oil. When the water is under control, as it is expected it will be in a short time, the output of oil will be larger. The result of the work on No. 1 is practically an assurance that the mesa field's future is assured. No. 1 looks like a forty or fifty barrel well.

Los Angeles, Cal.—The Los Angeles Union Oil Company has filed suit in the Superior Court against the city asking for a return of $42,920, which sum is claimed to have been paid by it for taxes. The company declares an assessment was levied on its corporate franchise in March, and that this action is void and the taxes paid under protest.

Bakersfield, Cal.—It has been announced at the local office of the Standard Oil Company that fifty cents a barrel would be paid for oil on daily runs. That is, oil which would be delivered without a previous contract and marketed daily to the Standard. This offer is extended to producers in the Kern River district, Midway and McKittrick fields. It is understood that quite a large amount of oil will be sold to the Standard at this figure.

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Northern Electrical Mfg. Co.
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Electric Appliance Co.
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Johns-Manville Co., H. W.
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